

HT03-010

1. A method for tuning read head bias, comprising:

providing a slider body having an air bearing surface and an opposing top surface;

forming a pair of parallel and overlapping magnetic shields at one end of the slider body and sandwiching a magneto-resistive read stack between said shields to form a magnetic read head that has an air bearing surface which is coplanar with that of the slider body; and

mounting on said top surface a permanent magnet, thereby effecting polarization of the shields at the air bearing surface and enabling said magnetic read head's bias point to be tuned.

2. The method of claim 1 further comprising narrowing and tapering said shields near said air bearing surface thereby enhancing said tuning of the read head's bias point.

3. The method of claim 1 wherein the step of tuning the magnet read head with respect to its bias point is performed in combination with perpendicular recording disk media having a magnetically soft underlayer.

4. The method of claim 1 wherein said magneto-resistive read stack is a GMR sensor or a MTJ sensor.

5. The method of claim 1 wherein said bias point relates to a biasing scheme that is

HT03-010

selected from the group consisting of abutted hard bias, abutted exchange bias, patterned exchange bias, and lead over-lay.

6. The method of claim 1 wherein said magneto-resistive read stack is a CIP type or a CPP type.

5 7. A method for tuning read head bias, comprising:

providing a slider body having an air bearing surface and an end surface normal to said air bearing surface;

forming a pair of parallel and overlapping magnetic shields on said end surface and inserting a magneto-resistive read stack between said shields to form a magnetic read head that has an air bearing surface which is coplanar with that of the slider body;

10 encapsulating said magnetic read head in a medium that has an outer surface parallel to said end surface; and

mounting on said outer surface a permanent magnet whose magnetization can be adjusted thereby enabling said magnet read head to be adjusted with respect to its bias point.

8. The method of claim 7 further comprising narrowing and tapering said shields near said air bearing surface thereby enhancing said tuning of the read head's bias point.

HT03-010

9. The method of claim 7 wherein the step of tuning the magnet read head with respect to its bias point is performed in combination with perpendicular recording disk media having a magnetically soft underlayer.

10. The method of claim 7 wherein said magneto-resistive read stack is a GMR sensor or a MTJ sensor.

11. The method of claim 7 wherein said bias point relates to a biasing scheme that is selected from the group consisting of abutted hard bias, abutted exchange bias, patterned exchange bias, and lead over-lay.

12. The method of claim 7 wherein said magneto-resistive read stack is a CIP type or a CPP type.

13. A process to manufacture a magnetic read head having an adjusted read head bias, comprising:

providing a slider body having an air bearing surface and an end surface normal to said air bearing surface;

on said end surface, forming a first magnetic shield;

forming a magneto-resistive read stack over, and fully under-lapping, said first shield;

HT03-010

forming and patterning an internal permanent magnet that is over said end surface and not over said read stack; and

forming a second magnetic shield that is over, and that fully overlaps, said read stack thereby forming a magnetic read head with an adjustable bias point.

5 14. The process described in claim 13 wherein said permanent magnet has a principal axis that is parallel to said magnetic shields.

15. The process described in claim 13 wherein said permanent magnet has a principal axis that is parallel to said magnetic shields and is magnetically connected to said first magnetic shield through a magnetic shield extender, whereby said permanent magnet may
10 be located at a distance from said first magnetic shield.

16. The process described in claim 13 wherein said permanent magnet has greater magnetic interaction with said first shield than with said second shield.

17. The process described in claim 13 wherein said permanent magnet has greater magnetic interaction with said second shield than with said first shield.

15 18. The process of claim 13 further comprising narrowing and tapering said shields near said air bearing surface thereby enhancing said tuning of the read head's bias point.

HT03-010

19. The process of claim 13 wherein said magneto-resistive read stack is a GMR sensor or a MTJ sensor.

20. The process of claim 13 wherein said bias point relates to a biasing scheme that is selected from the group consisting of abutted hard bias, abutted exchange bias, patterned exchange bias, and lead over-lay.

21. The process of claim 13 wherein said magneto-resistive read stack is a CIP type or a CPP type.

22. A read head that has been tuned for read head bias, comprising:

a slider body having an air bearing surface and an opposing top surface;

a pair of parallel and overlapping magnetic shields at one end of the slider body and a magneto-resistive read stack between said shields, together forming a magnetic read head that has an air bearing surface which is coplanar with that of the slider body; and

a permanent magnet, having a magnetic axis parallel to said top surface, mounted on said top surface.

23. The read head of claim 22 wherein said shields have been narrowed and tapered near said air bearing surface thereby enhancing said tuning of the read head's bias point.

HT03-010

24. The read head of claim 22 wherein said magneto-resistive read stack is a GMR sensor or a MTJ sensor.

25. The read head of claim 22 wherein said bias point relates to a biasing scheme that is selected from the group consisting of abutted hard bias, abutted exchange bias, and
5 patterned exchange bias.

26. The read head of claim 22 wherein said magneto-resistive read stack is a CIP type or a CPP type.

27. A read head that has been tuned for read head bias, comprising:

a slider body having an air bearing surface and an end surface normal to said air
10 bearing surface;

a pair of parallel and overlapping magnetic shields on said end surface and a magneto-resistive read stack between said shields which together form a magnetic read head that has an air bearing surface which is coplanar with that of the slider body;

said magnetic read head being encapsulating in a medium that has an outer surface
15 parallel to said end surface; and

a permanent magnet mounted on said outer surface to enable said magnetic read head to be adjusted with respect to its bias point.

HT03-010

28. The read head of claim 27 wherein said shields have been narrowed and tapered near said air bearing surface thereby enhancing said adjustment of the read head's bias point.

29. The read head of claim 27 wherein said magneto-resistive read stack is a GMR sensor or a MTJ sensor.

30. The read head of claim 27 wherein said bias point relates to a biasing scheme that is selected from the group consisting of abutted hard bias, abutted exchange bias, patterned exchange bias, and lead over-lay.

31. The read head of claim 27 wherein said magneto-resistive read stack is a CIP type or a CPP type.

32. A magnetic read head having an adjusted read head bias, comprising:
a slider body having an air bearing surface and an end surface normal to said air bearing surface;
a first magnetic shield on said end surface;
a magneto-resistive read stack over, and fully overlapped by, said first shield;
an integrated permanent magnet that is over said end surface and not over said read stack; and

HT03-010

a second magnetic shield that is over, and that fully overlaps, said read stack.

33. The magnetic read head of claim 32 wherein said permanent magnet has a magnetization axis that is parallel to said magnetic shields.

34. The magnetic read head of claim 32 wherein said permanent magnet has a principal
5 axis that is normal to said magnetic shields and is magnetically connected to said first magnetic shield through a magnetic shield extender, whereby said permanent magnet may be located at a distance from said first magnetic shield.

35. The magnetic read head of claim 32 wherein said permanent magnet is disposed
10 so as to have greater magnetic interaction with said first shield than with said second shield.

36. The magnetic read head of claim 32 wherein said permanent magnet is disposed
so as to have greater magnetic interaction with said second shield than with said first shield.

37. The magnetic read head of claim 32 wherein said shields are narrowed and tapered
15 near said air bearing surface thereby enhancing said tuning of the read head's bias point.

HT03-010

38. The magnetic read head of claim 32 wherein said magneto-resistive read stack is a GMR sensor or a MTJ sensor.

39. The magnetic read head of claim 32 wherein said bias point relates to a biasing scheme that is selected from the group consisting of abutted hard bias, abutted exchange bias, patterned exchange bias, and lead over-lay.

40. The magnetic read head of claim 32 wherein said magneto-resistive read stack is a CIP type or a CPP type.